Dec. 10, 1935. J. J. WARREN 2,023,455

PULP SHREDDER

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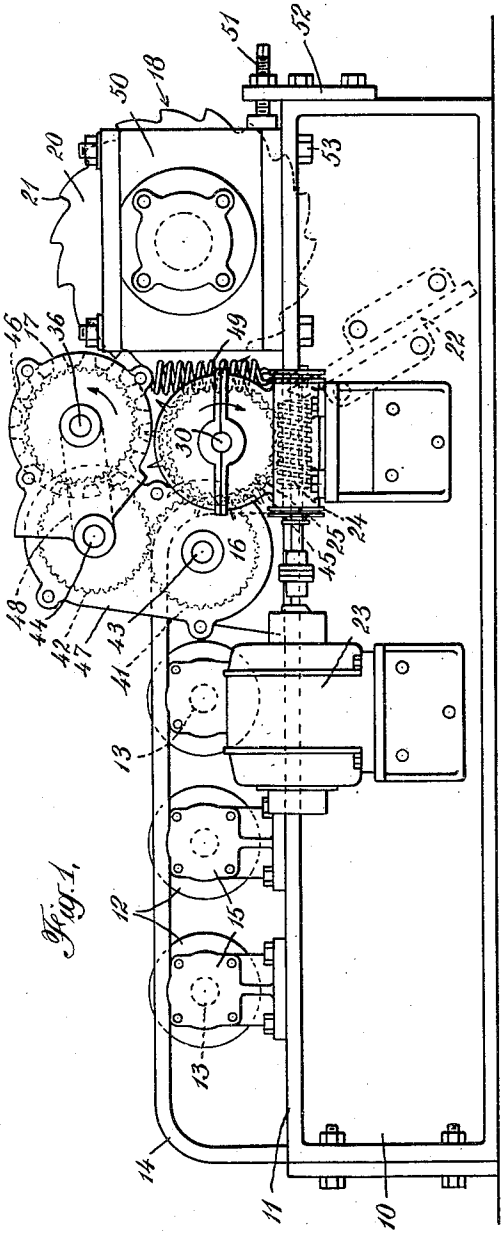

Fig. 1.

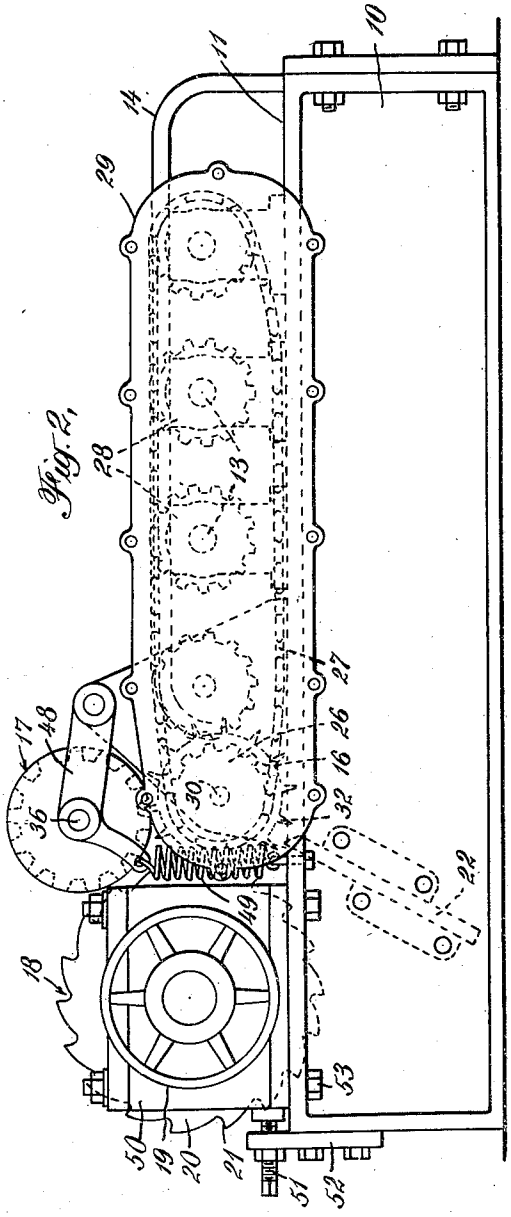

Fig. 2.

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Fig. 5.

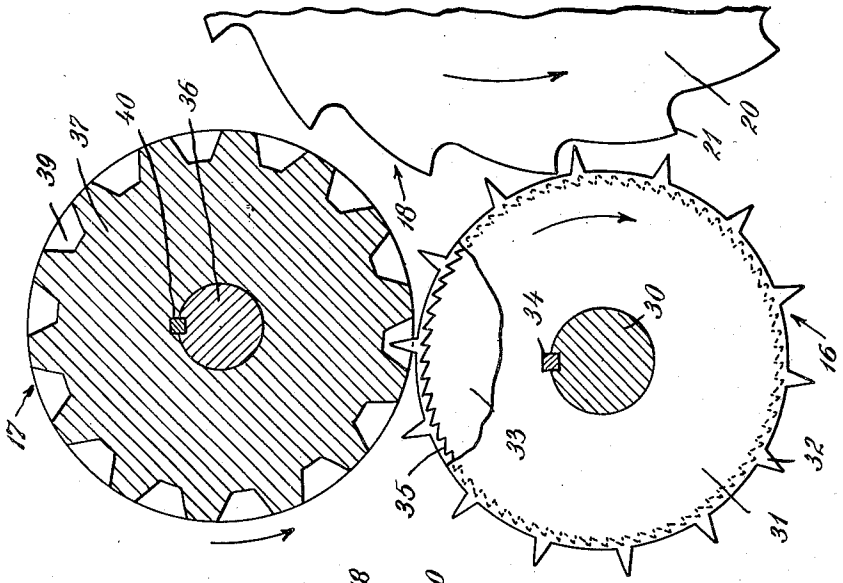


Fig. 4.

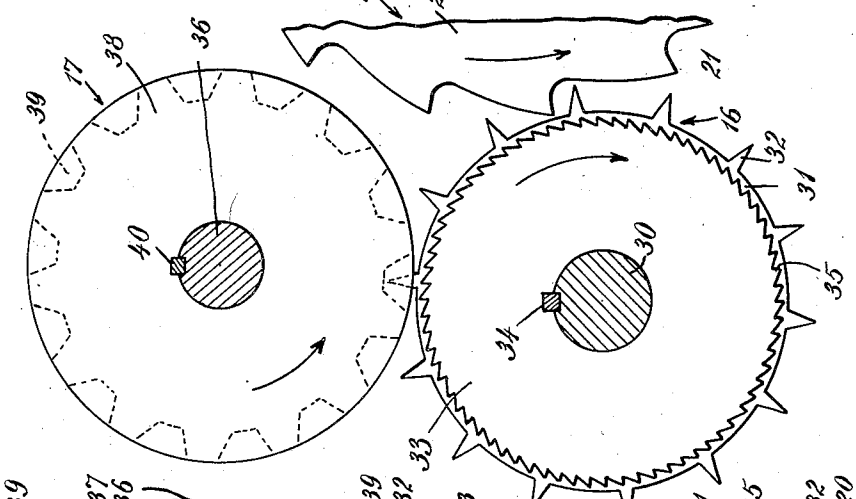
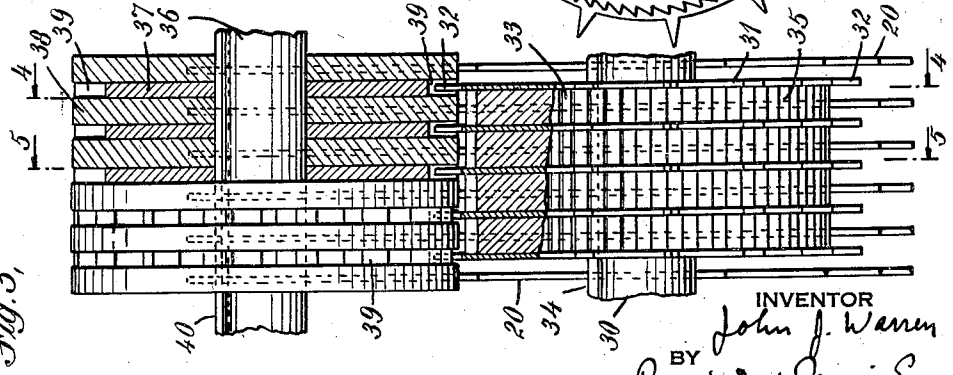


Fig. 3.



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2,023,455

PULP SHREDDER

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Application February 10, 1934, Serial No. 710,697

9 Claims. (Cl. 92—20)

This invention relates to machines for shredding pulp and similar materials and has for its object the provision of improvements in the means for feeding the pulp to the shredder blades.

Pulp shredders in common use today are provided with a pair of cooperating feed rolls between which the pulp laps are fed, and passed over a bed plate to a rapidly rotating shredder drum. These feed rolls move the pulp forward at a fixed rate thus limiting the quantity of pulp shredded per unit time and insuring uniformity of product, but only as long as any pulp remains between them. After the tail of a lap or sheet passes the nip of the rolls nothing remains to retard its forward movement but the inconsiderable friction of the bed plate. Consequently, the last few inches are frequently whipped forward by the shredder and appear as unshredded lumps in the stock.

In order to cure this defect in pulp shredding and to improve the quality of the stock, I have, in accordance with the present invention, provided means for positively gripping the entire length of each section of pulp and feeding it to the shredder blades at a uniform rate so that the last few inches are subjected to the same shredding action as the first. In doing this, I have eliminated the fixed bed plate, have moved the shredder drum toward the feed rolls so that the lower roll becomes in effect a moving bed plate, and have so constructed the feed rolls that the pulp in passing between them is pressed against projections on the face of the lower roll and the entire lap, including the tail, positively fed to the shredder blades.

For a better understanding of the invention, reference may be had to the accompanying drawings illustrating the preferred embodiment, in which—

Fig. 1 is a view in elevation showing one side of the machine;

Fig. 2 is a view in elevation showing the opposite side of the machine;

Fig. 3 is a sectional view partly in elevation showing the preferred construction of the feed roll;

Fig. 4 is a sectional view on the line 4—4 of Fig. 3; and

Fig. 5 is a sectional view on the line 5—5 of Fig. 3.

Referring to the drawings, the shredding machine illustrated includes a bed 10 having a platform 11 on one end of which is mounted a conveyor assembly of any conventional type. Preferably the conveyor is of the roll type and comprises a series of narrow rolls 12 mounted on the shafts 13 and spaced along the shafts in alignment to form rows extending lengthwise of the machine. The rows of rolls are separated by longitudinal bars 14 which are bent at their ends and secured to the machine bed, the bars forming a frame to prevent the material from falling down between the rolls. The shafts 13 are supported in bearings in the boxes 15 mounted on the platform on opposite sides of the machine. The conveyor rolls carry the pulp to a pair of cooperating feed rolls 16 and 17 respectively, and the feed rolls advance the pulp to a high speed rotary shredder drum, designated generally as 18, which is driven through a pulley 19 from an electric motor or other suitable power source, not shown. The shredder drum is of a conventional type and comprises a series of circular saw blades 20 having large teeth 21, the saws being spaced along the drum shaft by cast iron or other spacers to suit the feed rolls or material to be shredded. The shreds from the pulp lap fall against a backboard 22 secured to the bed of the machine.

It is desirable, in order that the pulp be fed to the shredding drum at an even rate, that the feed rolls and conveyor rolls be driven at the same surface speed, and to this end I prefer to use a variable speed driving motor 23 secured to the bed of the machine and connected through worm and wheel 24, 25 and reduction gearing to the lower feed roll 16, which in turn is geared to drive the conveyor rolls 12. A chain and sprocket drive is used between the feed rolls and conveyor rolls, including a sprocket wheel 26 on the feed roll shaft which drives an endless chain 27, the chain passing over similar sprocket wheels 28 mounted on the end of the shafts 13 of the conveyor rolls, and in this way the lower feed roll drives the conveyor rolls in unison and preserves the speed ratio between these members. The sprocket wheels and driving chain are concealed in a suitable housing 29 secured to the machine bed.

The pulp after passing through the nip of the feed rolls is advanced into the paths of the rotating shredder blade teeth 21. No stationary bed plate is employed. The blades travel at a high speed relative to the feeding movement of the rolls, and if means were not provided to grip the pulp after it has passed the nip of the rolls, the tail of each lap would be whipped forward by the shredder blades and would not be properly shredded. In order to positively grip and feed

the entire length of each lap of pulp being shredded, I provide one of the feed rolls, preferably the lower roll 16, with projections disposed around its cylindrical surface, and provide the other roll with means for pressing the pulp into engagement with these projections so that the entire lap is positively secured and fed to the shredder.

The lower feed roll, which is mounted on a shaft 36, comprises a number of circular discs 31 having sharp projections or spikes 32 disposed around their peripheries. These discs are separated from each other by spacers 33, the members being secured on the shaft for rotation by means of a key 34. The spacers are serrated on their cylindrical surfaces to form fine teeth 35 extending in a direction opposite to the rotation of the roll, these teeth serving to grip the bottom surface of the pulp which is pressed against the roll. The projections 32 on the discs, which protrude radially beyond the surface of the spacers, are pressed substantially through the pulp by the action of the upper roll.

The upper roll 17 which cooperates with the lower roll is of the same diameter and comprises a shaft 36 on which a series of discs 37 are mounted, the discs being spaced along the shaft in alignment with the circular discs 31 of the lower roll, by means of cylindrical spacers 38. The peripheries of the discs 37 are formed with notches 39 conforming generally with the shape of the projections on the lower roll and arranged to register with these projections upon rotation of the rolls. The surface of the spacers 38 on the upper roll between the discs serves to press the pulp down over the projections and against the gripping teeth 35 of the lower roll. The discs 37 and the spacers 38 are held on the shaft for rotation by means of a key 40.

From the foregoing it will be apparent that upon rotation of the feed rolls the pulp laps passing through the nip will be impaled on the projections and teeth of the lower roll and carried by the rotation of the roll into the paths of the shredding blade teeth 21. In order that the shredder blades may pass through the pulp on the lower feed roll without interfering with the projections 32, the circular saws 20 are spaced on the drum to align with the spacers between the discs 31 on the lower roll carrying the projections. In this way the shredder drum may be positioned so that the blades will almost touch the teeth 35 between the rows of projections. The speed of the blades passing through the pulp is greatly in excess of the feeding speed of the rolls so that the pulp is disintegrated into very small particles, the size of the particles being limited by the speed of the shredder drum relative to the feed rolls.

With the construction described, it will be apparent that the feed rolls must be driven synchronously to insure the proper registering of the projections on the lower feed roll with the openings in the upper roll. For this purpose I provide a positive driving connection between the lower and upper feed rolls which includes two intermeshing gears 41 and 42 of equal radius and mounted on shafts 43 and 44 respectively, the lower gear 41 being driven from a gear 45 on the lower feed roll shaft and the upper gear 42 meshing with and driving a gear 46 on the shaft of the upper feed roll. The shafts 43, 44 of the intermeshing gears are mounted on a frame 47 secured to the bed of the machine. In order to allow for variation in thickness of the pulp passing through the rolls, the shaft 36 of the upper roll is journalled on swinging arms 48 which are pivoted at their ends on the shaft 44 of the intermeshing gear 42, and in this way the roll is free to move up or down on the arms depending on the thickness of the pulp. The upper roll is held down firmly on the surface of the pulp to provide additional pressure at the nip of the rolls, by means of springs 49 at opposite sides of the machine.

The peripheral speed of the shredder blades is greatly in excess of that of the feed rolls but their relative speed can be varied and will depend upon the particular pulp being shredded. For example, when shredding sheets of sulphite approximately ⅛ inch thick a peripheral speed ratio of 40 to one would be suitable, while with thicker sheets or laps, which are sometimes two inches thick, a peripheral speed ratio of 40 to ½ would be used. The shredder drum normally rotates at about 1000 to 1600 R. P. M.

In order to provide for adjustment of the position of the shredder blades relative to the feed rolls, I provide bearing boxes 50 on opposite sides of the machine and mounted to slide longitudinally on the platform 11, the shaft of the shredding drum being supported in bearings in the boxes. An adjusting screw 51 is threaded into each of the boxes and held on an arm 52 secured to the bed of the machine, and in order to secure the boxes in position after an adjustment has been made, clamping bolts 53 are provided which extend through slots in the platform 11 and are threaded in the under sides of the boxes.

I claim:

1. In a pulp shredder, the combination of a rotary shredder drum and a pair of rolls for feeding separate sections of pulp to the drum, one of the rolls being provided with sharp projections for impaling and gripping each section throughout its entire length and feeding it while so impaled to the drum.

2. In a pulp shredder, the combination of a rotary shredder drum comprising a plurality of spaced saw-toothed blades, and cooperating feed rolls adjacent to said drum, said feed rolls including a roll having sharp projections disposed around the periphery thereof, and a second roll cooperating with said first roll for impaling on said projecting portions the material passing between the rolls, the projections carrying the material on said first roll into the paths of said saw-toothed blades.

3. In a pulp shredder, the combination of a rotary shredding drum comprising a plurality of spaced saw-toothed blades and cooperating feed rolls adjacent to said rotary drum, one of said feed rolls comprising spaced discs provided with peripheral spikes and a second roll cooperating with the first roll for impaling on said spikes the material passing between the rolls, said saw-toothed blades being spaced to intercept the path of the material on said first roll and, passing between said rows of spikes, extend substantially to the base thereof.

4. In a pulp shredder, the combination of a rotary shredding drum having a plurality of working elements extending from the periphery thereof, and cooperating feed rolls adjacent to said rotary drum, said feed rolls including a roll having projecting portions disposed around the periphery thereof, and a second roll cooperating with said first roll for impaling on said projecting portions the material passing through the

rolls, said second roll having a plurality of openings in the cylindrical surface thereof for receiving the projecting portions passing into the pulp, the projecting portions carrying the material into the paths of said working elements.

5. In a pulp shredder, the combination of a rotary shredding drum having a plurality of working elements extending from the periphery thereof, and cooperating feed rolls adjacent to said rotary drum, said feed rolls including a roll having projecting portions disposed in axially spaced rows around the periphery thereof and teeth on the cylindrical surface of the roll between said rows of projecting portions, and a second roll cooperating with said first roll for impaling on said projecting portions and said teeth the material passing through the rolls, said first roll carrying the material into the paths of said working elements.

6. In a pulp shredder, the combination of a pair of cooperating feed rolls which includes a lower roll comprising a shaft, a plurality of circular discs mounted on the shaft and having projecting portions extending from the peripheries thereof, and spacers interposed between the circular discs, and an upper roll having a plurality of openings disposed in the cylindrical surface thereof and arranged in axially spaced rows aligned with said discs for receiving the projecting portions thereon.

7. In a pulp shredder, the combination of a pair of cooperating feed rolls which includes a lower roll comprising a shaft, a plurality of circular discs mounted on the shaft and having projecting portions extending from the peripheries thereof, and cylindrical spacers interposed between the discs and provided with teeth on the cylindrical surfaces thereof, and an upper roll having a plurality of openings disposed in the cylindrical surface thereof and arranged in axially spaced rows aligned with said discs for receiving the projecting portions thereon.

8. In a pulp shredder the combination of a rotary shredder drum and a pair of rolls for feeding separate sections of pulp to the drum, one of the rolls being provided with spikes for impaling and gripping each section throughout its entire length and feeding it to the drum, means permitting automatic adjustment of the distance between the feeding rolls and means for imparting a peripheral speed to the shredder drum greatly in excess of that of the feed rolls.

9. In a shredding machine the combination of a rotary shredding drum comprising a plurality of spaced saw-toothed blades, cooperating feed rolls adjacent said shredding drum for feeding separate sections of material thereto, one of said feed rolls having axially spaced rows of peripheral spikes, the other feed roll cooperating with the first for impaling on said spikes the material passing between the rolls, whereby each section of material is gripped throughout its length as it is fed to the shredding drum, said saw-toothed shredding blades being spaced so as to pass between the spikes on the first feeding roll and extend substantially to the base thereof, and means for rotating the shredder drum at a peripheral speed much greater than that of the feed rolls.

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